

The Polish Air Force's Conversion to the F-16:
Emergence from the Soviet Legacy

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Abstract

Poland's current leadership considers active involvement in the North Atlantic Treaty Organization (NATO) and close bilateral political-military cooperation with the United States (US) to be essential in guaranteeing Poland's external security [65]. In order to strengthen the transatlantic security concept in Europe and become fully integrated into NATO defense structures, Poland has made modernizing its military one of its top priorities. Although participation in the war in Iraq has greatly accelerated these efforts in terms of combat experience [86], much of Poland's equipment and weaponry remain holdovers from the Soviet era. This is especially true in the Polish Air Force (PoAF) which continues to operate a fleet of aging Soviet aircraft. In many ways, the prolonged reliance on Soviet equipment and its associated modus operandi has perpetuated the existence of an outdated, Soviet-style military culture within the PoAF which has hindered its transformation into a modern Western fighting force.

In January of 2003, the Polish Air Force placed an order for 48 American F-16 fighter aircraft in order to upgrade its military capabilities and facilitate its integration into NATO. The F-16 represents the first Western fighter aircraft that the PoAF will operate since World War II and it brings with it a completely new set of operational philosophies, tactics, training methods and maintenance procedures. Because these aspects each characterize a very tangible divergence from Soviet operational influence, preparations to fly the F-16 are significantly facilitating the Polish Air Force's adoption of Western (NATO) air practices. Although there are certainly many growing pains, the imminent delivery of the F-16 (scheduled to begin in November 2006) is providing the PoAF with both the impetus and necessity to overcome the institutional barriers which have impeded progress in the past.

This thesis describes some of the most salient characteristics of the Polish Air Force as it exists today as a product of the Soviet legacy. The main objective is to identify departures from the status quo which will be necessary to achieve successful F-16 operations. Areas of particular interest are flying culture, pilot training, maintenance personnel and airfield infrastructure. The thesis concludes with a brief discussion of several specific issues, which if not addressed, threaten to significantly confound the conversion process.

1 Introduction

1.1 *Poland's Current Security Strategy*

Poland's current security strategy considers active participation in the North Atlantic Treaty Organization (NATO) and close bilateral political-military cooperation with the United States (US) "to constitute the most important guarantee of [Poland's] external security and stable development" [65]. This policy is rooted in history and stems from an underlying existential anxiety which dates back to Poland's 18th century partitioning between Prussia, Russia and the Austro-Hungarian Empire. Subsequent 20th century invasions by both the Nazis and the Soviets only helped to intensify Poland's underlying angst. These fears have manifested themselves as recently as 2001 during European Union (EU) accession negotiations concerning the free purchase of Polish land by foreigners. Poland proposed an 18-year transition period before finally compromising with Brussels on a 12-year hiatus ([8], p. 19). Furthermore, Western Europe's reactions (or lack thereof) during the buildup to and aftermath of World War II have indelibly implanted doubts in the minds of many Poles about Western Europe's willingness to support Poland in a crisis [58]. This history has led Warsaw to align itself closely with Washington in order to establish the United States as Poland's security guarantor. An excellent example of this is Poland's support of the war in Iraq.

Implicit in Poland's political and military support for the American led invasion of Iraq was a clear message to the US that Poland could be counted on as a strong and reliable American ally. The unspoken hope being that, should it ever be necessary, the US would prove itself to be every bit as strong and reliable an ally to Poland [3][58]. Speaking at Wrocław University in October of 2004, Polish president, Aleksander Kwaśniewski responded to members of the Wrocław Anti-War Coalition that, "We [Poland] must have excellent relations with America and strengthen the transatlantic security concept in Europe. I am convinced that without the United States, Europe is for the time being incapable of assuring itself security" [53]. Kwaśniewski's focus here on "strengthening the transatlantic security concept in Europe," which was designed principally to provide stability in Europe and defend against Soviet aggression, speaks volumes about underlying Polish motivations for its strong alliance with the United States.

Several modern-day examples of Russian interference in the affairs of its neighbors illustrate that Polish security preoccupations are not entirely unfounded. The Moldovan Foreign Minister recently described Russian pressure to restructure his country as not in the interest of the majority of the Moldovan people and primarily motivated by “imperial ambitions” [12]. In Georgia, the Russians have been vehemently opposing Georgian efforts to re-establish their country's territorial integrity, remove Russian military bases and eliminate breakaway Russian-sponsored regimes in South Ossetia and Abkhazia [64]. These two examples are even more alarming when seen in the context of Russia’s plans to establish an economic union state with Belarus [69] and recently proposed Russian legislation that facilitates the incorporation of former Soviet Republics into Russia [11]. Moreover, many feel that Russia’s attempt to influence the 2004 presidential election results in the Ukraine clearly demonstrated a return to its imperialist past. Some analysts predicted that the situation in the Ukraine could have easily escalated into a bloody conflict, creating a hot spot very close to Poland's eastern border [62]. This case in particular, highlights the validity of Poland’s present-day security concerns.

1.2 Military Modernization

In order to achieve its objective of strengthening the transatlantic security concept in Europe and to enhance its ability to participate in NATO exercises, Poland’s current leadership has stated that one of its most important security goals is the modernization of its military [65]. The institutional transformation necessary to emerge from the Soviet legacy does not come without its share of challenges. One obvious obstacle in this regard has been budgetary constraints stemming from years of defense drawdown after the collapse of the Warsaw Pact. In February of 2001, NATO formally criticized Poland for failing to meet its military funding commitment of 2.1% of Gross National Product (GNP) and for not allocating enough of its defense spending to essential hardware modernizations [9]. Subsequent reforms in Poland’s military planning system and defense budget have led to recent successes in stabilizing Poland’s transformation efforts [52].

Partly responsible for these successes is the fact that Poland has been able to capitalize on its participation in the war in Iraq to leverage a dramatic increase in military funding

from the United States. Although it is estimated that Poland's expenditures in maintaining its troops in Iraq amount to approximately US\$100 million per year [21], these costs have been at least partially offset by American military aid with the promise of more to come [36]. The Polish military has received more than a 10-fold increase in Foreign Military Funding (FMF) grants from the US in just two years from US\$5 million in 2002 to US\$66 million in 2004 [21][48]. These grants include military equipment such as the five C-130 transport aircraft that the US will provide to Poland free of charge.

This trend in aid from the US is very likely to continue. President Bush announced in February 2005 his intent to ask Congress to increase military aid to Poland even further, from US\$66 million to US\$100 million, noting that, "Poland's been a fantastic ally because the people of Poland love freedom" [36]. Furthermore, in leading and equipping the multi-national division during the invasion, the Poles transported approximately US\$250 million worth of their own military equipment to Iraq [48]. Conditions in the desert have rendered much of it unsalvageable. Because the cost of servicing and repairing this equipment would be excessive, it is likely that 90% of it will remain in Iraq for good. Hence, Poland stands to effectively incur an enormous deficit in military hardware upon its departure from Iraq. As payback for Poland's role in the war, it is very likely that the US will be compelled to provide assistance in replacing this equipment [21].

Military funding notwithstanding, the experience of commanding a large multi-national troop formation during complicated combat operations in Iraq has exponentially accelerated Poland's military transformation. Participation in Iraq has resulted in approximately 10,000 Polish troops (given the current troop rotation system) that now have combat experience in concert with Western forces [86]. For a military which has been largely inactive during the past 50 years (except for peacekeeping missions), the significance of this experience in terms of military readiness and combat effectiveness is enormous. In this regard, one high ranking Polish military official called the Polish participation in Iraq, "the absolute best thing that has happened to the Polish military since joining NATO" [48].

1.2.1 Soviet Equipment

Despite these successes, much of Poland's weaponry and military equipment are holdovers from the Soviet era. One of the best examples of this is Poland's aging fleet of Soviet-built fighter aircraft. In the early 1980s, the Polish Air Force (PoAF) had over 1000 aircraft in its inventory which included over 450 Soviet-made fighters [48]. These numbers were significantly reduced during the defense drawdown which occurred in the following years. Today, the Polish Air Force has a total of about 420 aircraft at its disposal, of which less than one-third are fighters. With the last of Poland's MiG-21 aircraft retired in early 2004, the Polish Air Force's current fighter fleet consists of 88 Su-22's and 45 MiG-29s [80]. Poland acquired 23 of its 45 MiG-29s from Germany who inherited them from the former East German Air Force after Germany's reunification. The German government essentially donated these aircraft to Poland for a symbolic one euro per aircraft in exchange for Poland's future cooperation with the German defense industry [20]. Delivery of the MiG-29 aircraft took place in 2003 and 2004.

Although seemingly very cost effective, many of the donated aircraft were in poor repair and required extensive servicing and upgrades. To further complicate matters, the Russian government claimed intellectual property rights over these MiG-29s [43]. Citing problems of "piracy" in the production and modernization of weaponry, the Russians asserted that any modifications desired by the Poles must first be approved by Moscow. In practice, this has meant monetary compensation. Only approximately 20 of Poland's 45 Mig-29s are currently operational [48].

Likewise, of the 88 Su-22s in Poland's inventory, only about 20 or so are in good working condition [48]. One reason for this is that many of these aircraft require replacement of a pyrotechnic device used by the Su-22's ejection seat. The necessary item is only manufactured in Russia and the Russians have been obfuscating the path to supplying it. This has significantly hindered the PoAF's efforts to repair these aircraft and return them to operational status [48]. These matters were important topics of discussion during Polish President Kwaśniewski's visit to Moscow on September 29, 2004 [39] and have made fulfilling the PoAF's current NATO obligations with its existing fighter fleet increasingly difficult.

1.2.2 NATO Obligations

The Polish Air Force is currently fulfilling several important NATO commitments. First, it is responsible for providing NATO with a 24-hour, 365-day-a-year strip alert in order to intercept rogue aircraft which enter NATO airspace [48]. In this way the Poles provide air-to-air defense of such NATO entities as the Air Sovereignty Operation Center (ASOC) which provides peace time airspace surveillance and air policing capability. Such missions promote the PoAF's interoperability within existing NATO air defense elements. To fulfill this requirement, the Polish Air Force provides MiG-29s on both 15-minute and 90-minute alert (where the time designation indicates the time necessary to generate and launch) [48]. An additional contingent of PoAF MiG-29s is currently preparing to assume NATO air policing responsibilities over Lithuania, Latvia and Estonia. The Polish Air Force is scheduled to begin its Baltic mission in January 2006 [10]. In terms of an air-to-ground capability, the PoAF offers NATO two squadrons of Su-22 aircraft which are capable of deploying worldwide within 5 days of notification [48].

The benefits of active NATO participation are many. In addition to providing valuable operational experience in cooperation with other Western air forces, accepting NATO taskings makes Poland eligible for the NATO Security Investment Program (NSIP). This program provides military funding to enable hardware and infrastructure modernizations amongst its members. NSIP funds will reach approximately US\$100 million in 2005 [50]. Such funds have been used to finance approximately 121 military projects in Poland to date of which 24 have been completed [51]. Among these endeavors are 6 airfield modernization projects such as the one recently completed at the Polish Air Force Base in Malbork [63]. Beyond monetary benefit, becoming a valuable asset to NATO will implicitly increase Poland's influence in transatlantic security affairs and by extension enhance its political clout within Europe [61]. Because of this, the Polish Air Force aspires to take on an even more active role within NATO. Its near term goal (5-7 years in the future) is to become NATO's emergency expeditionary air force [48]. The central pillar of this vision is the PoAF's decision to purchase 48 American F-16 aircraft which will be delivered between 2006 and 2008.

1.2.3 Purchase of the F-16

In order to replace its aging Soviet fighter aircraft and accomplish its ambitious NATO aspirations, Poland placed an order for 48 American made F-16s in January of 2003. The US\$3.5 billion order represents the biggest defense contract by a former Soviet-block country to date [73]. The deal included an offset agreement worth over US\$6 billion in US investment in Poland over the next 10 years [60][73]. Poland's decision to purchase American aircraft in the face of two European-built models is, like the war in Iraq, another superb example of Poland's proclivity towards the US. Although many factors undoubtedly went into choosing the F-16, strengthening political, military and economic relations with the US clearly outweighed any feeling of European solidarity. Indeed, the makers of the two rival aircraft, the Swedish-British Saab JAS 39 Gripen and France's Dassault Mirage 2000, were furious with Poland for making what they called a politically influenced decision [73]. Poland's two smaller neighbors, the Czech Republic and Hungary, both opted to accept the Swedish-British offer and procure 14 Gripen aircraft each [1][14][44]. Despite choosing different manufacturers, many of the institutional challenges faced by the air forces of all three of these former Soviet satellites in converting to Western equipment are extremely similar. Likewise, all three air forces are benefiting tremendously from the positive cultural changes which the injection of the new Western aircraft is driving.

1.3 Institutional Change

1.3.1 Organizational Culture

Broadly defined, culture is a set of attitudes, values, goals, and practices that characterize a certain group of people. In reference to institutions, culture is often used to describe a shared modus operandi. This usage is very applicable to military organizations whose collective norms and values are often reflected through their common practices ([18], p. 2). Another important facet of culture, especially for the current work, is that it is a learned phenomenon which is passed on from generation to generation. Because human nature is inclined to preserve the customs and traditions of the past, an organization's culture tends to resist change in the absence of sufficient impetus. An excellent example is the slow pace of military transition in post-communist Central and Eastern Europe (CEE).

1.3.2 Impetus for Change

Despite the breakup of the Warsaw Pact and subsequent accession of many of its former members into NATO, the institutional military culture in CEE remains very much a product of the Soviet legacy ([25], p. v), [48]. This has made integration into Western security structures somewhat difficult. Tischner dubbed the term *Homo Sovieticus* to describe in more general terms how the Soviet system remains very much a part of the psyche of those who lived through it [77]. This expression applies quite accurately to the present air force leadership throughout post-communist Central and Eastern Europe. The majority of those currently in charge came up through the ranks during the Soviet era and attended professional military academies in the Soviet Union (see section 3.2.1). The fact that the Soviet system is imbedded within these leaders has implicitly impeded transformation efforts since 1989 [47]. Moreover, the continued reliance of CEE air forces on Soviet aircraft and training methods has further confounded the transition to NATO-style air operations ([25], p. 12-13). The injection of modern Western aircraft stands to change matters significantly.

Although the investment is substantial and the transitional period difficult, the procurement of modern Western aircraft has provided the air forces of Poland, Czech Republic and Hungary with both the impetus and necessity for positive cultural change. The new equipment, procedures and tactics all facilitate cultural transformation and make clinging to ways of the past much more difficult. In contrast, the Russian Air Force has neither new Western equipment nor practices to assist it in overcoming what in 1988 General Shaposhnikov of the Soviet Air Force called “obstacles such as oversimplification, formalism, over-cautiousness, and the fear of accepting responsibility for a demanding task [which] remain almost insurmountable in the path toward accelerated progress in [air] combat” [67]. In this context, the urgency created by the imminent delivery of the Western aircraft and the cultural changes that it is enabling are perhaps the most compelling benefits of the acquisition project. In order to examine some of the most salient institutional changes which confront the PoAF as it converts to the American F-16, cultural differences between the Polish and US/Western air forces will be cast into Hofstede’s familiar cross-cultural framework whenever possible [30][31]. A brief review of these concepts is provided below.

1.3.3 Cross-Cultural Framework

By studying work-related values among IBM employees in the 1970's, Hofstede derived five major dimensions of organizational culture: individualism/collectivism, uncertainty avoidance, power distance, future orientation and masculinity/femininity [30][31]. Perhaps the most widely known application of Hofstede's work is the Global Leadership and Organizational Behavior Effectiveness (GLOBE) project [32]. Over a ten year period, the GLOBE study surveyed over 17,000 middle managers in 62 different countries in the banking, food processing and telecommunications industries. Survey results were used to correlate and numerically rank the various national societies in each of Hofstede's cultural dimensions. The GLOBE findings are often used to study and interpret cross-cultural interactions in multinational settings. Such applications usually delineate cultural patterns by nationality.

In the current military context, however, empirical evidence suggests that the most significant cultural challenges faced by the PoAF in converting to the American F-16 and NATO-style air operations are due to artifacts of the Soviet military influence rather than general societal differences between Poland and the United States (see sections 2.2.5.1, 2.2.5.2, 3.1.1 and 3.2.1). This premise is supported by the work of Carl, Gupta and Javidan who suggest that although organizations tend to mirror the values of their host societies, this is often not the case for military organizations [15]. The fact that the air forces of over 20 other nations worldwide currently maintain successful F-16 operations lends credence to this argument. Among the European air forces which fly the F-16 are those of Belgium, Denmark, Greece, Italy, the Netherlands, Norway and Portugal. Because the host societies of these air forces represent a virtual spectrum of cultural specificities vis-à-vis the GLOBE results and as such numerically bound those of Poland, it is illogical to presuppose that Polish societal norms present unusual obstacles for developing successful F-16 operations. Much more significant is the fact that the PoAF is the first former Warsaw Pact air force to fly the F-16. This factor creates a unique set of challenges for the Polish Air Force and substantially differentiates it from the other European air forces mentioned above. Hofstede's framework will be used throughout this thesis in interpreting the influence of Soviet military culture on the PoAF's conversion efforts. The first three dimensions are most relevant to the current work and are defined below.

1.3.3.1 Individualism/Collectivism

“Individualism pertains to societies in which the ties between individuals are loose: everyone is expected to look after himself or herself. Collectivism as its opposite pertains to societies in which people from birth onwards are integrated into strong, cohesive in-groups” ([30], p. 51). In the context of operating aircraft, this dimension will be extremely helpful in describing the fundamental differences in flying culture which exist between the US and Polish Air Forces (see sections 2.2.5 and 3.1.1). Transitioning from their current collectivistic approach to air operations inspired by Soviet-style control from the ground to the more autonomous, individualistic style practiced in the West represents the most significant challenge for Polish pilots as they convert to the F-16.

1.3.3.2 Uncertainty Avoidance

Hofstede defined uncertainty avoidance as, “the extent to which the members of a culture feel threatened by uncertain or unknown situations” ([30], p. 113). In other words, it measures the level to which group members seek orderliness, consistency, structure, formalized procedures and laws to govern situations in their daily lives [74]. Both historical and empirical evidence will be presented which suggests a relatively high degree of uncertainty avoidance within the PoAF (see sections 2.2.4, 2.2.5 and 3.2.1). While counterproductive in many ways (especially in developing individual initiative in the cockpit), a tendency toward high uncertainty avoidance in some ways may programmatically be an asset to the PoAF. The work of Sully de Luque, Javidan, and Aditya [74] suggests that high uncertainty avoidance and risk aversion can be advantageous during the implementation phase of a new endeavor by instigating tight controls (see section 4.2.1.3).

1.3.3.3 Power Distance

Power distance refers to “the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally” [30], p. 28). This dimension will be helpful in describing current efforts by the PoAF to develop a professional enlisted corps in a military culture which has been primarily dominated by officers for the past 50 years. Encouraging the officer corps to nurture and empower professional enlisted members in their roles as technical experts will be instrumental in developing a successful maintenance culture within the PoAF (see sections 2.2.4 and 3.2.1).

1.4 Thesis Organization

The remainder of this thesis is organized as follows. Chapter 2 begins with a brief review of the communist takeover in Poland, the imposition of the Party system and its interdependence with the military establishment. The aim in the first part of the chapter is to demonstrate that the Communist Party system had a heavy influence on the evolution of Soviet-style military culture. The latter part of Chapter 2 examines the development of Soviet-style airpower and focuses specifically on aircraft design and operational culture. The primary objective here is to correlate many of the challenges which the Polish Air Force faces today with their origins in the Soviet system. Chapter 3 will present the current state of affairs within the Polish Air Force and investigate some of the more salient issues involved in its conversion to the F-16. In particular, this section will cover the areas of flying culture, pilot training, maintenance personnel and airfield infrastructure. Next, Chapter 4 provides a brief discussion of several outstanding issues, which if not addressed soon, threaten to significantly disrupt the conversion process. The thesis concludes with a brief summary in Chapter 5 and areas for future research in Chapter 6.

2 Evolutions of the Polish Air Force

2.1 A Proud Tradition

Although the history of Polish military aviation dates back to before the First World War [83], Polish airmen are perhaps most widely known for their contributions during World War II (WWII). Although Poland suffered heavy casualties during the Nazi air invasion at the outset of the war, many Polish pilots fled Poland and successfully made their way to England through France. Because the Royal Air Force (RAF) was in dire need of pilots, the British agreed (albeit somewhat reluctantly) to form four bomber and two fighter squadrons comprised entirely of dislocated Polish airmen. These Polish RAF units played a key defensive role during the Battle of Britain. The 144 Polish pilots who participated registered over 200 confirmed air-combat victories while sustaining only 29 losses [55]. Such success was in large part due to the excellent training these pilots received in Poland prior to the war.

Pilot training in pre-war Poland was extraordinarily rigorous. It emphasized flying proficiency and air combat expertise. Dog-fighting skills were continuously honed in various multi-aircraft configurations and regular gunnery exercises were conducted. The training was so difficult that only the most outstanding officers were able to successfully complete it. The following is a description of one of the Polish Air Force's many training exercises as described by a Polish WWII pilot [55].

A colored, small parachute was thrown out of the cockpit in flight. The trainee, always keeping it in sight, had to climb 300-400 meters (1000 ft), stall into a spin, and recover at just the right moment to fire exactly *one* shot with his camera gun. In most cases, not only did they not lose sight of the parachute, but they *scored* on the shot!

The aerobatic ingenuity demanded during such innovative training exercises taught Polish airmen to be creative and resourceful during air combat. These abilities translated directly to success on the battlefield. In total, Polish RAF pilots flew over 105,000 sorties and registered 746 confirmed victories against Nazi forces [83]. The Polish units were notorious for their tenacity and skill. One Nazi fighter pilot noted in

his journal that “Poles are excellent pilots...they're unpredictable, they fight fiercely like dogs and damned well at that” [55]. Unfortunately, the Soviet shadow that descended over Poland at the conclusion of the war would soon work to suppress the very skills that had given Polish pilots their competitive edge.

2.2 Soviet Influence

2.2.1 Communist Takeover in Poland

Unfortunately for the Poles, victory in World War II did not bring an end to oppression. Desperate to keep the Red Army engaged on the eastern front, Churchill and Roosevelt made large concessions to Stalin concerning the Soviet influence in Central and Eastern Europe. Roosevelt commented at Yalta, “Of one thing I am sure, Stalin is not an imperialist.” Such naiveté would prove to have disastrous consequences for the people of Albania, the Baltics, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, Yugoslavia and elsewhere. To this day, many in the region feel a sense of being “sold-out” by the West in the aftermath of the war.

Notwithstanding the failings of Allied negotiations, Stalin’s conquest of the Eastern Block was a well thought-out and methodical process ([17], p. 211). His *modus operandi* was to first establish left-wing, anti-fascist forces in a particular country that he could then use to gradually neutralize political opposition. In Poland, communism had been outlawed in 1938 and remained extremely unpopular even during the Nazi occupation. This situation necessitated that Stalin create a new reality in Poland. He started in the summer of 1941 by parachuting in a communist initiative group to establish the Polish Workers Party. By 1944, communist forces in Poland had grown considerably and were well organized. The so-called Lublin Committee which controlled local Communist Party politics was formed as a Soviet-friendly alternative to the Polish government in exile in London ([17], p. 217).

The communist takeover in Poland was greatly facilitated by the ill-fated Warsaw Uprising of 1944 ([17], p. 218). During the 63 day struggle for Warsaw, the Nazis wiped out virtually all of the Polish Home Army. Quite fortuitous for Stalin, this underground Polish militia also represented the only organized political and military

anti-communist forces remaining in Poland. Seeking to fully exploit these circumstances, Stalin ordered his Soviet troops poised on the banks of the Vistula River not to interfere as the Nazis systematically destroyed Warsaw. With all serious opposition eradicated, the Soviet backed Lublin Committee (with only minimal participation from the London government in exile) had little difficulty establishing itself as the official Polish provisional government at the close of the war. Although the remnants of the Polish Home Army continued to fight a guerilla style civil war for a period of time, complete control of the country was achieved by the Communists by early 1947 ([17], p. 221). The Sovietization which would take place in Poland during the subsequent years would see the penetration of the Communist Party into almost every facet of human existence.

2.2.2 Party in Uniform

The Communist Party of the Soviet Union (CPSU) and those modeled after it in Central and Eastern Europe were designed to maintain total control of society [46]. The Soviet system was characterized by a high degree of centralized control whereby the decisions of the Communist leadership were considered absolute and not subject to challenge by subordinate organizations ([17], p. 243). Party mechanisms were ubiquitous and their hierarchy spanned from the federal level of government all the way down to the most minute levels of public and private life. Compliance at all levels was monitored by security forces which ensured that Party policy was obediently carried out ([17], p. 247-248). In this way, the Party endeavored to control all aspects of life within the State. The military was no exception.

Party tentacles ran particularly deep within the military because the armed forces were the ultimate guarantors of Party supremacy. Only those officers who showed the highest level of ideological loyalty were allowed to advance to leadership positions. The most promising Central and Eastern European officers were groomed for command at military academies in the Soviet Union where they would often spend several years. Upon their return, such military elites were then aggressively integrated into the Party structure and were often appointed to high ranking Party positions. In effect, they served a dual role as both an agent of the Party within the military and as a military officer within the Party [46].

Beyond the military leadership, Party organizations could be found at all levels of the command structure [40]. In order to bolster Party loyalty among the ranks, such groups met regularly to discuss and reinforce the connection between military life and Party membership [36]. In return for their allegiance to the Party, military members in general enjoyed higher salaries, better housing, superior healthcare and a more prestigious social standing than their civilian counterparts [37]. Such benefits nurtured Party loyalty by giving military officers a vested interest in preserving the system which provided them their relative well being in society. In addition to material gain, military members were perpetually indoctrinated using an extensive system of professional and political education.

To supplement Party control of the military, a dual command structure was created whereby military leaders were shadowed by politically appointed civilian deputies. These Party-sponsored officials were empowered to overrule the orders of their military counterparts and reprimand or even discharge commanders considered to have questionable Party loyalty [37]. In addition, military members regardless of rank were allowed to submit grievances concerning their superior officers directly to these political appointees without adherence to the normal military chain of command [37]. Such a system was designed to provide the Warsaw Pact with a politically reliable, pro-Soviet command structure.

2.2.3 Integration within the Warsaw Pact

One of the most significant motivations behind the formation of the Warsaw Treaty Organization (WTO) was that it allowed Moscow to consolidate military control over its allies [40]. In order to create a reliable set of Central and Eastern European forces which were combat viable but yet incapable of autonomous military action, the Soviets merged the individual command structures of its satellites into a single WTO body which was ultimately controlled by Moscow. Cohesion between Soviet forces and those of its satellites was cultivated through combined staff organizations and joint military training exercises. The possibility of independent CEE military action was reduced by keeping satellite forces dependent on Soviet operational direction, training guidance and logistical support [40]. The resulting combined command structure was replete with

implicit military obligations and provided the Soviet Union with considerable leverage over the other members of the Warsaw Pact [76]. An excellent example of this was the ability of the Soviet Union to compel Polish, Hungarian, East German and Bulgarian military participation in the invasion of Czechoslovakia in 1968 [22].

The cornerstone of Moscow's strategy of creating an integrated Warsaw Pact military capability was the development of a pro-Soviet Central and Eastern European military elite [40]. To this end, the Soviet's undertook an aggressive program of recruiting, socializing and indoctrinating CEE commanders using seven professional military academies in the Soviet Union. Attendance at one of these academies was in most cases compulsory for promotion beyond the rank of Major and all key command and staff positions throughout the Warsaw Pact were held by graduates. Literally thousands of officers from each satellite attended Soviet academies where they received years of acculturation in Soviet psychological and behavioral norms. Courses of study instilled common values in students using common experiences, hardship, tactical doctrine and language (Russian). Newly graduated CEE officers would then return to influential command positions within their home countries to propagate Soviet military culture and political orientation.

Perhaps the most convincing validation of this strategy occurred in Poland during the crisis of 1980-81. General Jaruzelski's Soviet-sponsored ascension to the Party leadership, the subsequent military coup and the imposition of martial law represent a textbook example of the military's role as the ultimate guarantor of Party supremacy [46]. The proud military tradition in Poland allowed the armed forces to maintain a high degree of legitimacy even when the Party was nearly politically bankrupt. An opinion poll taken at the height of Solidarity's popularity in the spring of 1981 showed that while only 7% of Poles maintained a favorable view of the Party, 68% retained their confidence in the military [37], ([17], p. 374). General Jaruzelski, who was ultimately loyal to Moscow, used this authority to impose martial law, dismantle Solidarity and save the Communist Party (albeit temporarily) from imminent collapse [46].

This discussion is relevant to Poland's current military transition in that many of the generals currently occupying key command positions within the Polish armed forces are products of the Soviet system and attended professional military academies in the Soviet

Union. Specifically in the Polish Air Force, many of the key decision makers involved in preparations for delivery and operation of the F-16 fall into this category (see section 3.2.1) [47]. To varying degrees, these Polish officers continue to perpetuate the Soviet military culture that they were exposed to during their formative years.

2.2.4 Soviet Military Culture

It is not surprising that the Communist Party system, with its centralized decision making, demand for unquestioning obedience and extensive monitoring network, shaped a Soviet military culture characterized by high levels of both power distance and uncertainty avoidance (see section 1.3.3). Henderson's 1985 analysis depicts a very top-heavy Soviet military which was void of a strong enlisted component. Because of this, the officer corps in the Soviet military performed many functions which in the West are performed by sergeants and non-commissioned officers (NCOs). The lack of a strong NCO corps resulted in a large power distance between officers and enlisted personnel. Henderson described a Soviet officer corps that often had an "elitist attitude that in many respects made it an extremely privileged class, one that emphasized material benefits and the prerogatives of rank and position."

The Soviet training mentality believed that stress caused by the fog of war was the biggest obstacle to effective combat operations. Likewise, Soviet military culture exhibited an overt contempt for independent thought and individual initiative. Instead, Soviet training methods focused on reducing the uncertainty of combat using "an extremely exacting and comprehensive set of military regulations that prescribed the correct actions and behaviors for almost all envisioned circumstances" ([28], p. 135). The Soviet system strictly enforced adherence to regiment and stressed continuous repetition of very detailed training drills. The rationale was that even though a soldier's ability to think clearly during battle would inevitably become impaired, his ability to perform well-rehearsed drills would not. In this way, the Soviets truly believed that "drill and repetition would win out over intellect, wit and initiative" ([28], p. 135).

An atmosphere of intense supervision and ubiquitous monitoring inherently nurtured a military culture characterized by the fear of failure and the avoidance of blame. This is hardly a startling result in a military system that had sent returning Red Army soldiers released from Nazi prisoner of war (POW) camps to the Gulag for "cooperating with the

enemy.” Consequently, employing independent judgment and deviating from prescribed procedures was rare because strict adherence to regulations was the only means of shielding oneself from liability. For the same reason, junior and mid-level commanders were very reluctant to make decisions and relied heavily on orders from more senior commanders. Such behavior was quite common even for what would be considered very routine matters by Western standards (see also section 3.2.1). Henderson notes that the problem was so acute that most Soviet leaders, at all but the top levels of command, would be literally paralyzed if lines of communication with higher headquarters were to be severed ([28], p 139). This fact was a consequence of a Soviet military culture which conditioned officers to avoid uncertainty (and therefore blame) by deferring responsibility in all matters to the chain of command.

2.2.5 Soviet Air Operations

2.2.5.1 Aircraft Design

An institutional culture laden with the fear of failure and the avoidance of uncertainty was not exclusive to the ranks of active duty military officers. It was also endemic to the Soviet scientific and engineering community which was responsible for designing and producing weaponry for the Red Army. This was particularly true for aircraft designers. Stalin instituted severe consequences for failed designs under the guise of what he referred to as “technological discipline” ([72], p. 16). Designers routinely lost their jobs for relatively small technical missteps and endured imprisonment or even execution for more serious design failures. Even the best Soviet scientists and engineers such as Andrei Tupolev and his contemporaries were terrorized, arrested and imprisoned in special forced-research laboratories in the 1940’s. Such conditions continued after Stalin’s death. Khrushchev incarcerated the aircraft designer Aleksandr Arkhangelskii for failing to generate a successful prototype of the Tu-110 Soviet airliner. Even into the 1980’s, mistakes in design could cause significant detriment to an engineer’s career, standard of living and social standing ([72], p. 16).

Similar to the situation in the military, the high price of failure created a design culture within the Soviet research and development community that was extremely risk averse. As one would expect, this environment had a profound influence on Soviet aircraft design. While Western design practices evolved to emphasize system versatility and

advanced technology, Soviet engineers were taught to avoid design uncertainty by stressing simplicity and incremental innovation ([72], p. 16). Whereas Western designers would venture to build a single fighter aircraft to carry out a variety of missions (e.g., air superiority, ability to strike hardened targets, aerial support of ground forces, etc.), Soviet engineers usually designed aircraft with a specific, limited function in mind. As an example, while the MiG-21 and Su-22 were designed primarily for air-to-air and air-to-ground roles respectively, the F-16 was designed to fulfill both missions. This is particularly germane to the current situation in Poland because all of the PoAF pilots selected to receive F-16 training in the US were formerly trained in the single-role MiG-21 (see section 3.1.1).

The Soviet single-role approach was based on the concept that a specifically designed aircraft could perform its mission better than any multi-role counterpart. Furthermore, by designing an aircraft for a single specific function, operations could be simplified enormously by eliminating superfluous equipment and weapon systems. Conversely, the multi-role approach argues that because it is impossible to predict the proportionality of aircraft losses during conflict, it is much better to possess flexible (albeit more complex) aircraft which are competent in performing several missions reasonably well [19][82]. This approach accepts that a wide range of components and weaponry will be necessary in order to provide the aircraft with a variety of capabilities.

Beyond simplicity of purpose, Soviet designs stressed straightforward techniques in fabrication and assembly. Many parts were fashioned out of conventional, easily obtainable materials such as steel, even at significant weight penalty. Often resisting the temptation to use newer technology, the Soviets relied on long assembly-line style production runs of proven designs. They favored introducing new technology incrementally and accepted quantity over quality when confronted with production delays or lags in technology. An excellent example of this can be seen in the comments made by a Western analyst who examined the Soviet MiG-21 aircraft captured by the Israelis during the 1967 war. One of the analyst's most interesting observations was that he found gaps of up to one-eighth of an inch in the skin panels of the aircraft's fuselage. This lack of detailed finishing speaks volumes about the Soviets clear preference to accept poor workmanship and associated performance degradations (in this case excess

skin friction) rather than delays on the production line [26]. The Soviet design approach was perhaps best summarized by Andrei Tupolev in 1973 ([45], p. 57).

The country [Soviet Union] needs aircraft like it needs black bread. Of course, you can imagine pralines, tortes, etc., but to no purpose--we haven't the ingredients to make them. From this it follows: (a) that we must develop a doctrine concerning the missions which aviation is to perform, and that doctrine must be based on a realistic conception of the capabilities of projected aircraft; (b) that, on the basis of technology and production processes which have already been assimilated, we must turn out long production runs of those aircraft which correspond to that doctrine; (c) that if these aircraft fall somewhat behind those in the West in terms of technology--to hell with them; we'll get by on quantity; and (d) that, in order to prevent quality from falling *too* far behind quantity, the design bureau should (i) concentrate on the technology of constructing experimental aircraft, without being burdened with responsibility for series production, and (ii) work on two basic tasks: designing aircraft intended for production and designing purely experimental aircraft used to achieve technological breakthroughs.

The final objective targeted by Soviet design simplicity was to make aircraft easy to fly for the average pilot. The Soviet philosophy was that producing aircraft which were simple to operate would make pilots less encumbered during the difficult conditions of air combat and thus more likely to achieve victory. The goal of reducing pilot workload during air combat in part led to the evolution of a Soviet-style operational culture in which ground controllers provided pilots with a great deal of direction and guidance. Through this modus, the Soviets were effectively trying to reduce the uncertainty associated with flying to the fullest extent possible. Although to some extent well-intended, this ground-based strategy also included a collectivistic aspect which openly discouraged displays of independent thought and initiative in the cockpit. As presented in the next section, this fact rendered Soviet pilots disproportionately dependent on scripted maneuvering and instructions from the ground.

2.2.5.2 Operational Culture

Starting in the 1970s, Soviet air-combat tactics and training were the subject of extensive study in the US. At that time, the United States Air Force (USAF) was implementing a series of training initiatives designed to provide American pilots with realistic air-combat experience against Soviet adversaries. Such exercises were designed to address poor combat performance of American pilots during the conflict in Vietnam. The so-called “Red Flag” exercises at Nellis Air Force Base in Nevada are perhaps the most well-known of the training exercises which grew out of this initiative. At Nellis, the USAF organized permanent aggressor squadrons which were tasked with simulating Soviet air-combat style and tactics (although with American aircraft). Mock air combat with the aggressor squadrons was then used to provide American fighter pilots with a very realistic training environment.

The American pilots assigned to the aggressor squadrons were tasked with becoming experts in Soviet weaponry and air-combat tactics. Because direct knowledge of Soviet tactics was largely unavailable, aggressor pilots combed through Soviet Air Force magazines and other military writings, interviewed Soviet defectors and studied the air tactics of those states which operated Soviet aircraft (e.g., North Vietnam, Egypt and Syria). These analyses yielded a picture of Soviet-style air operations typified by scripted maneuvering and direction from the ground. This operational mind-set was very different from the “free-form initiative and adaptability” taught in the West ([38], p. 71). Because of this, many Western pilots viewed the typical Soviet pilot as “merely a cog in a wheel, as a rigid by-the-book aviator who deferred to his ground controller on all important decisions, and above all as the product of an operational culture that made a point of teaching him not to do much thinking for himself” ([38], p. 72). This assessment, too some extent, was corroborated by the testimony of a group of Indian Air Force pilots who had attended MiG-21 training in the USSR in the early 1970s.

2.2.5.2.1 Soviet MiG-21 Conversion Training

In a 1986 interview, a group of Indian Air Force pilots gave an open account of their experiences in the early 1970s during MiG-21 conversion training in the Soviet Union. This group of experienced pilots, which was trained in the British system, expressed a great deal of frustration with Soviet training methods. Not only did they remark that the

course progressed extremely slowly by Western standards, but they described an instruction style which emphasized repetitive drilling of procedures similar to the “way small children learn multiplication tables, with students frequently chanting the correct answers in unison” [27], ([38], p. 74). Procedures were prescribed down to the most minute detail and included such things as “proper head and hand movements for various procedures and functions in the cockpit” ([38], p. 74). The Indian pilots went on to say that any display of personal initiative which deviated from strict and rigidly defined procedures was not tolerated. One Indian pilot reflected that, “any deep thought about how to get the best out of one’s aircraft, or even hack an unusual situation, was simply not part of the syllabus” [27]. This description of the Soviet pilot training environment goes a long way in explaining the performance of Soviet MiG-21 pilots in actual air combat with the Israeli Air Force over Suez in 1970.

2.2.5.2.2 Suez Engagement of 1970

In response to increasingly dominant Israeli airpower during the 1969-70 War of Attrition, the Soviet Union deployed surface-to-air missile batteries, early warning radars and two squadrons of 36 MiG-21 interceptor aircraft to Egypt in the spring of 1970 [16]. On July 30th, 1970, an intense air engagement took place between Soviet and Israeli forces. Approximately 6 Israeli F-4s, 8 Israeli Mirages and 16 Soviet MiG-21s were involved in the clash [16]. At the end of the intense five-minute dogfight, the Israeli pilots had destroyed 5 Soviet MiG-21s and suffered no casualties [16]([38], p. 108).

In an interview after the engagement, Israeli pilots reported that their Soviet counterparts joined the fight aggressively and flew “textbook” formations ([38], p. 108). After the battle started, however, their ability to support one another disintegrated and they began making simple mistakes including firing their missiles outside of effective range. One Israeli fighter pilot commented that he quickly realized that his adversary was inexperienced and that the Russian pilot “didn’t know how to handle his aircraft in a combat situation” [16]. Consequently, after the Soviets’ initial formations fell apart, they lacked the adaptability to react to changing threats as the air battle unfolded. In effect, they lost their situational awareness and therefore their ability to fight.

In the aftermath of the engagement, it was clear that the Soviet pilots had been outmatched because of their inextricable dependence on ground control intercept (GCI) and their inexperience in conducting unscripted air-combat maneuvers in a dynamic, multi-aircraft environment [16]. The outcome, however, was not a reflection on the individual aptitudes of the pilots involved, but rather on the manner in which they had been trained to fly and fight. The Soviet pilots simply hadn't been taught the skills necessary to think on their feet during situations which required rapid reaction independent of help from the ground. This reliance on GCI was further exposed in 1983 during the Soviet downing of Korean Airlines Flight 007.

2.2.5.2.3 Korean Airlines Flight 007

On August 31st, 1983, Korean Airlines Flight 007 strayed off course over a Soviet missile installation in the northern Pacific and was shot down by a Russian Su-15 fighter aircraft. 269 passengers and crew were killed [71]. The published transcript of the affair plainly demonstrated the heavily encumbered nature of Soviet ground-directed air operations [7].

After establishing first visual contact with the Korean Air Boeing 747 at 18:05 GMT, the Soviet interceptor required an additional 14 minutes to engage and shoot down the airliner [7]. During that period, the GCI controller was continuously providing the pilot with specific heading and altitude information. The controller continued providing guidance and instructions even when the Su-15 pilot had visual contact with the target. Despite closing to within 6,000 feet of the airliner, the pilot was unable to positively identify it [7] and generally failed to “show any other sign of initiative” during the entire ordeal ([38], p. 73).

The behavior of the Soviet pilot, as observed from his radio transmissions during this incident [7], is strikingly reminiscent of Henderson's more general description of the average Soviet officer being at a loss without instructions from higher headquarters (see section 2.2.4). Although such glimpses into Soviet tactical air operations provided Western strategists with valuable insight during the Cold War, the veritable wealth of information that became available after the collapse of the Soviet Union helped the West considerably in filling in the gaps between reference points.

2.2.5.3 Soviet-Style Air Tactics and Training

The examples cited above do an excellent job in highlighting some of the most salient features of Soviet air-combat tactics and training. Needless to say, the majority lie in sharp contrast to those practiced in the West. The most significant differences can be placed into three main categories. The first concerns Soviet reliance on prearranged plans and inflexible flight rules. Such operations imposed a predetermined procedure for almost every imaginable flight situation. Although motivated by the desire to reduce pilot uncertainty during flight, such a system rendered pilots unable to adjust to real time mission changes. In fact, General Shaposhnikov, commander of the Soviet Air Force in 1990, cited several accidents that had occurred because of what he called, “the inability of Soviet pilots to adapt to a change in plans after the mission briefing” [66].

Although Western pilots also place a great deal of emphasis on mission preparation, flexibility in the air is one of the key tenants of Western air power. It was the author’s personal experience as a flight test mission controller at Edwards Air Force Base in California that USAF preflight mission briefings are as well very detailed and carefully planned out. However, during the mission itself, a great deal of creativity on the part of the pilot was routinely exercised in reacting to day-light restrictions, weather conditions, traffic interference, fuel limitations, range requirements, aircraft performance restrictions, system malfunctions and other unexpected events. It was the pilot’s responsibility to address such considerations in the air and adjust the mission in real-time in order to achieve maximum test efficiency.

The second major difference with Western air practices is the dominance of ground controllers in supervising and directing air-combat operations. Ground control in the Soviet Air Force was extremely invasive and consisted of a flight director, a radar controller, a regiment-level supervisor and a ground tactical control officer. Roughly speaking, these posts combined the functions in the USAF of ground-controlled intercept (GCI), control tower, supervisor of flying (SOF) and runway supervisor. The chief difference in the two systems was that the Soviet ground team was responsible for making many decisions which in the West are the responsibility of the pilot. In other words, the Soviet approach to air operations was more collectivistic in nature and the

Western approach more individualistic. One example of this is that Soviet ground controllers would often provide guidance even for such rudimentary procedures as deciding when the pilot should select afterburner during an intercept ([38], p. 80). This, in essence, is tantamount to the ground controller flying the aircraft by means of verbal remote control of the pilot. Such operations and implicit deferral of aircraft control would be inconceivable to any USAF fighter pilot.

The final and perhaps most fundamental difference between Soviet and Western air practices was Soviet contempt for and overt discouragement of individual initiative and independent judgment in the cockpit. An inherent symptom of the first two characteristics, this mixture of uncertainty avoidance and collectivism represented a significant liability for Soviet pilots. The ability to adapt and think on the fly is vital to retaining situational awareness and will almost always mark the difference between surviving an air engagement and being shot down. Because of this, the Soviet training system was unwittingly putting its airmen at a considerable disadvantage by teaching them to be dependent on scripted routines and ground control (as illustrated in section 2.2.5.2.2). The influence of such failings pervaded the air forces of the Warsaw Pact and its vestiges have created significant challenges for former Soviet satellites as they strive to adopt Western air practices.

2.3 Emergence from the Soviet Legacy

2.3.1 German Reunification

The fundamental differences in approach outlined above render the transition from Soviet to Western-style air operations very difficult. This fact was first demonstrated by the experiences of the Luftwaffe after the reunification of Germany in 1990. Upon the disintegration of the Soviet Block, the West German Air Force found itself in the unique position of inheriting 23 Soviet MiG-29 aircraft and 47 MiG-29 pilots from the former German Democratic Republic (GDR) [4]. For several years in the early 1990's, the German Air Force continued to operate these aircraft as air defense assets. Initially, the majority of the MiG-29 aircrews were formed from the ranks of former East German Air Force pilots. These aircrews had been trained to fly in the Soviet-style (see section 2.2.5.3) and consequently were unfamiliar with Western air combat maneuvers, tactics

and multi-aircraft operations [79]. After extensive interviews with the GDR aircrews, one Western analyst reported that it appeared that they had been told “where to fly, when to turn on their radar, when to shoot, and when to come home” [70]. Subsequently, the Luftwaffe’s commander was forced to initiate a retraining program designed to expose the former East German pilots to Western tactical methods.

A core of approximately 42 former GDR MiG-29 pilots decided to accept retraining which carried with it a reduction in rank, an intensive course in English and the extensive study of Western democracy [79]. To this group was added a very experienced cadre of West German instructor pilots who were tasked with training the former East German pilots in NATO tactics and operations. Although the West German instructor pilots had far fewer hours in the MiG-29 than the students that they were instructing, their performance in mock air-combat was markedly superior to their East German counterparts who continued to rely on choreographed maneuvering (uncertainty avoidance) and ground control (collectivism). One West German instructor pilot commented that it was very difficult for the former East German pilots to adapt to a system where, “nobody’s helping from the ground, telling there’s a target...where to turn, where to go and what to switch on” [79]. Many of the pilots who underwent the retraining program actually became disoriented due to the overload of information that they were suddenly expected to process independently. It soon became clear to the Luftwaffe’s leadership that retraining on a more basic level would be necessary.

The most promising of the former GDR MiG-29 pilots were offered the opportunity to be retrained from scratch at basic fighter pilot training school at Euro/NATO headquarters at Sheppard Air Force Base in Texas. Many of these pilots washed-out immediately and in the end only about 13 of the original cadre of 42 were successfully retrained and integrated into the unified German Air Force [79]. These stark numbers illustrate just how difficult the process of converting from Soviet-style to Western air practices is. In this context, it is not surprising that an arduous set of challenges currently confronts the air forces of Poland, Czech Republic and Hungary as they prepare to make the same transition.

2.3.2 Hungary and the Gripen

Among the most difficult tasks which confront the Visegrad countries today as their air forces convert to Western practices is shrugging off the institutional culture which developed during 40 years of Soviet military domination. In the East German case, reunification provided the necessary “shock treatment” which compelled the pilots of the former GDR to relinquish outdated Soviet-style air operations characterized by uncertainty avoidance and collectivistic controls and adopt modern Western methods. In contrast, the necessary transformation has been taking place much slower in other former Warsaw Pact nations. Although accession into NATO has provided some tangible impetus for change, a sense of urgency equivalent to that created by the German reunification simply has not existed. The lack of a clear and immediate need for change has enabled the remnants of the Soviet system to continue to exert considerable influence on current military air operations throughout Central and Eastern Europe.

As late as the mid-1990’s, the Hungarian Air Force (HuAF) continued to operate its fleet of 28 MiG-29 aircraft based on Soviet training manuals published in the 1970s ([25], p. 12-13). Because of this, Hungarian pilots were still being taught an operational style based on choreographed maneuvering and GCI vectoring ([25], p. 13). In 1999, Hungary joined NATO and received assistance in many areas through participation in joint exercises and officer exchanges. The HuAF even received guidance from the German Luftwaffe based on its experiences in operating the MiG-29 in Western fashion ([25], p. 14). Despite such endeavors, the HuAF found progress slow due to technical and procedural barriers tied to their Soviet aircraft. Major Tbor Gardus, a Hungarian fighter pilot with over 20 years experience, stressed in his 2002 Master’s thesis that adopting Western training methods and tactics was essential in order for the HuAF to achieve full integration into NATO air defenses ([25], p. v).

In 2001, the Hungarian Air Force decided to lease 14 brand-new, fourth-generation, Swedish-British JAS 39 Gripen fighter aircraft. Not only was this decision motivated by the desire to augment the military capabilities of the HuAF, but also by the need to break away from Soviet equipment and its associated *modus operandi*. The first Gripen

aircraft are scheduled to arrive to Hungary in March 2006 [41]. Preparing for delivery of these aircraft and the Western technology/procedures that they infuse is significantly bolstering the HuAF's efforts to adopt NATO-style air operations. An analogous situation currently exists in Poland where preparations for the delivery of 48 American F-16 aircraft have been significant enablers of productive change. The next section will present a detailed look at the current state of affairs in the Polish Air Force as it prepares to operate the F-16.

3 The Polish Air Force Today

In many ways, the imminent delivery of F-16 aircraft to the Polish Air Force scheduled to begin in November 2006 embodies the same sort of “shock treatment” that Germany’s reunification provided for the Luftwaffe. On going preparations are serving to both facilitate the identification of necessary modernizations and also provide the military leadership with the immediacy for carrying them out. Despite the growing pains which are normal whenever familiar patterns are disrupted, the injection of modern Western equipment and procedures has been a significant enabler of constructive change. Indeed, the very tangible objective of preparing to operate the new Western jets and the urgency that it has created are perhaps the most compelling benefits of the PoAF’s decision to procure a Western fighter.

3.1 Operational Culture

Consistent with the experiences of the former GDR pilots after Germany’s reunification (see section 2.3.1), shrugging off a flying culture based on scripted maneuvering to reduce uncertainty and collectivistic control from the ground represents a much more profound challenge to Polish aircrews than simply learning to fly a new aircraft. This is because the basics of flying a fighter aircraft, be it Soviet or American, are fundamentally similar. Although engine power, maneuverability and cockpit layout certainly vary between designs, a fighter pilot experienced in one aircraft can quickly compensate for such factors to become proficient in the general operations of another fighter aircraft (i.e., take-off, basic flying, landing). The much more difficult task for Polish pilots, however, will be learning to effectively employ the new weapons system using Western methods and tactics. A good analogy is that although a person learns to drive in one car, they can (with very little effort) successfully operate many other automobiles despite varying engine size, transmission types and handling characteristics. But if that same driver was then asked to use the new vehicle in a racing situation, they would need to acquire the proper training in both technique and strategy in order to successfully compete in the race.

The ability to effectively employ a fighter aircraft as a weapon system involves a very specialized set of skills which lie at the core of the differences between Soviet-style and

Western air practices. The Western approach centers on the pilot and his ability to independently monitor, process and react to a given situation in real-time. Conversely, the Soviet system, consistent with its centralized denial of autonomy, emphasized ground control of pilot actions. The biggest challenge for the seasoned Polish pilots who will be trained to fly the F-16 will be making the transition away from this familiar collectivistic approach and adopting the more individualistic style practiced in the West [30][78].

3.1.1 Converting to the F-16

The first four F-16's will be delivered to the PoAF in November 2006. The PoAF will then receive four more aircraft every few months until the last ones arrive in mid-2008. To allow the PoAF to start flying the planes as soon as they arrive, 13 Polish pilots are currently scheduled to be trained in the US. In order to develop an indigenous training capability in Poland, 6 of the 13 will be trained as F-16 instructor pilots. When deciding which pilots would be chosen to fly the F-16, the PoAF saw an opportunity to leave stability in its Su-22 and MiG-29 pilot corps by utilizing pilots who flew the recently retired MiG-21. The first Polish Mig-21 pilot selected to attend F-16 training was Lieutenant Colonel (Lt Col) Rościsław Stepaniuk. An extremely experienced and competent pilot, Stepaniuk has amassed over 1000 hours of total military flying time. Approximately 600 of these hours were flown in the MiG-21 [49]. He started his training in early 2004 at the 162nd Air National Guard Fighter Wing in Tucson, Arizona which specializes in training foreign F-16 pilots from around the world. Because all of the Polish officers who will attend F-16 training in the US are former MiG-21 pilots, a brief comparison of the two aircraft is appropriate.

3.1.1.1 F-16 vs. MiG-21

At first glance, perhaps the most significant difference between the F-16 and the MiG-21 is that the former's cockpit is designed such that the pilot sits in a reclined position under a bubble canopy. Although this offers increased visibility, the unconventional positioning can cause pilots who are used to flying in more classically designed aircraft (such as the MiG-21) to lose spatial orientation at times. In addition, the F-16's pressure-activated, joystick-style controller is fixed to the side of the aircraft and only

moves a few millimeters in all directions. The MiG-21's control stick is situated between the pilot's legs and offers a much fuller range of motion. Consequently, a pilot used to the MiG's more conventional control stick might initially over steer the F-16. In terms of instrumentation, the F-16 has a heads-up display (HUD) which projects critical flight information on the windscreen. This allows pilots to continue to look outside the cockpit during air combat while retaining the ability to quickly access flight information. Deciphering the data can at first be difficult for pilots who are more comfortable with conventional displays such as those found in the MiG-21. With respect to performance, the F-16's advance handling characteristics and tremendous engine thrust make it much more agile than the MiG-21. Furthermore, the F-16's structural design allows it to pull and sustain 9g's (i.e., 9-times the force of gravity). In the MiG-21, high-g maneuvering was more limited in duration and was further constrained by fuel weight and altitude [49].

3.1.1.2 Conversion Challenges

Despite what appear to be significant differences in the F-16 and MiG-21, the factors mentioned above amazingly don't represent significant obstacles for an experienced pilot. In fact, during a phone interview conducted on May 6th, 2005, Lt Col Stepaniuk commented that he only required a handful of flights to become comfortable with basic flight operations in the F-16 [49]. Although this was true from a pure flying standpoint, Lt Col Stepaniuk did identify several other areas that represented more significant challenges for him. Among these he cited conducting radio communications entirely in English and operating in a very busy US flying environment without ground controllers as the most demanding tasks that he was confronted with.

3.1.1.2.1 Flying in English

Before arriving in Tucson, Lt Col Stepaniuk attended a 3-month training course in English at the Defense Language Institute English Language Center (DLIELC) at Lackland Air Force Base (AFB) in San Antonio, Texas. Lt Col Stepaniuk stressed during the May phone interview that he entered this training with English skills good enough to have a normal, everyday conversation and that he was even more fluent when he completed the course. Despite this, Stepaniuk conceded that the flying environment

in the US demanded a level of English that he still was not prepared for. He stated that although the preparatory language course did teach him a lot of aviation terminology, it did not improve his verbal communications skills enough for flying. Stepaniuk commented that,

During flight, pilots are expected to hear and respond immediately to the various radio communications which they are confronted with (from air traffic control, other aircraft, etc.). There is no time for translating from English to Polish and then vice versa to formulate a response. The communication in the air is not always clear and you really have to focus on your call sign and on directions to jump to various radio frequencies. If you don't catch what is being said, it creates frustration on the part of the controllers and it can create a hazard because you could lose your situational awareness. A couple of years ago we [the PoAF] started conducting flying exercises in English. But it wasn't the same as flying in the US where there is a lot of traffic and the airspace is very busy. This even creates problems for the American students. For the international students it is really challenging. There is no place for repetition or misunderstandings especially when you are flying the F-16 which is a very fast aircraft. It really takes time to develop confidence with communications [49].

As a result of his experiences and recommendations, the next batch of 12 Polish pilots will receive an additional 3-months (or 6-months total) of English training at the DLIELC before commencing the flying program.

3.1.1.2.2 Flying in a New Environment

After Lt Col Stepaniuk's 3 months at language training, he arrived in Arizona where he completed several weeks of F-16 academics and simulator work before starting to fly the F-16. Lt Col Stepaniuk remarked that,

Things were very challenging for me from the very beginning, not from a simple flying standpoint, but because the system of operations

in the US (i.e., airspace management, communications, airfield procedures, pilot responsibilities, traffic avoidance, etc.) was completely different to what I was used to in Poland. Because the F-16 is a more advanced, better equipped aircraft than the MiG-21, flying in the F-16 is actually in many ways easier than in the MiG-21 in terms of just operating the aircraft. The environment presented by the F-16, however, is much more demanding in terms of the amount of information that you are expected to process on your own without help from the ground [49].

He went on to describe how flight operations differ in the US and Poland. Stepaniuk said that in the US, he needed to be prepared for a much broader flying environment. Because the F-16 can carry a lot of fuel, pilots routinely fly to several different airfields, practice various approaches and patterns, do touch-and-go landings, conduct combat maneuvers, drop ordnance at the range and rehearse emergency procedures all in a single mission. Conversely, missions in the MiG-21, which was designed specifically as a high-speed interceptor, were quite short and often limited to only 30 to 40 minutes. Because of fuel constraints, MiG-21 operations needed to be much more rigidly scripted and typically only included takeoff, transit to the military operating area (MOA), aerobatics, return transit and a single-approach landing. In other words, it is much more difficult to reduce mission uncertainty in the F-16 than it was in the MiG-21.

Another major difference that Lt Col Stepaniuk cited was that Polish airfields (until recently) lacked instrumentation such as Tactical Air Navigation (TACAN) and Instrument Landing Systems (ILS) which are standard parts of any Western airbase. These systems allow pilots to navigate and land independently of ground control in the absence of a visual frame of reference (e.g., in bad weather or at night). When he arrived at Tucson, Lt Col Stepaniuk was completely unfamiliar with this equipment and was confronted with learning to use it simultaneously with learning to fly the F-16. In describing the individualistic approach to flying employed in the US, Lt Col Stepaniuk explained that,

In the US, you are put in the situation of having to do a lot of things for yourself in the cockpit. For example, TACAN and ILS wasn't

available in Poland when I flew the MiG-21. MiG-29 and Su-22 pilots started using it a couple of years ago, but even so there are only a few stations available. Instead we relied almost entirely on the ground controllers at night and in poor weather for navigation. This is opposed to in the US, where the aircraft have modern equipment on board to provide the pilot with a much broader picture of his situation. Consequently, pilots in the US don't need any help from ground controllers. While this makes the task of flying easier, you have so much information and so much equipment that it is easy to get over tasked if you are not well prepared for such a busy environment [49].

After a five flights in the F-16, it became clear to Lt Col Stepaniuk's instructor pilots that despite being a smart and capable pilot, he lacked the necessary instrumentation skills that students are required to have when they enter F-16 training [47]. This was not a reflection in any way on Stepaniuk's flying abilities, but simply a consequence of the fact that he had been trained in a totally different system. Lt Col Stepaniuk reflected that,

My experience in Tucson as a MiG-21 pilot was completely different from most of the other foreign students because we [Polish MiG-21 pilots] haven't flown extensively using the English language and we haven't used a lot of Western instrumentation and procedures. I was put in the position to learn to operate in an entirely new system completely from scratch, while most of the other international students were more familiar with the Western procedures [49].

3.1.1.3 Intermediate Fighter Training

In order to provide Lt Col Stepaniuk with the necessary instrumentation training, he discontinued the F-16 program to attend intermediate fighter training at Randolph Air Force Base in Texas. While there, he flew approximately 65 hours in the twin-engine supersonic T-38 training aircraft. Instruction in the T-38 is a standard part of USAF fighter training and it bridges the gap between subsonic training aircraft such as the T-6 Texan or T-37 Tweet and much more advanced, supersonic aircraft like the F-15 and F-

16. The course emphasis was on instrumentation and formation flying. Lt Col Stepaniuk (speaking again during the aforementioned phone interview) remarked that not only did the five-month course teach him how to fly using TACAN and ILS, but it gave him broad exposure to the American flight system and its associated procedures. He reflected that, “The program was very high quality and extremely professional. It provided me with a lot of knowledge and experiences so that upon completion I was in a much better position to begin flying the F-16” [49]. Based on this feedback, the next batch of 12 Polish MiG-21 pilots will also attend a 5-month T-38 course at Randolph AFB. The training, which will include extensive instrumentation academics and approximately 50 hours of flight time, will culminate with the USAF instrumentation check flight. Successful completion of this in-flight exam will mark the prerequisite for entry into F-16 training. The course will provide Polish students with the prerequisite knowledge of instrumentation systems such as TACAN and ILS so that they will be free to focus entirely on learning how to fly the F-16 when they arrive in Tucson. In addition, this training will allow Polish pilots more time to make the transition from the risk-averse, collectivistic approach to flying that they are familiar with to the busier and more individualistic approach characteristic of Western flight operations.

After completing the T-38 training, Lt Col Stepaniuk returned to Tucson to resume the F-16 program. Since returning from Randolph he has been progressing steadily in his mastery of basic F-16 operations. To date Lt Col Stepaniuk has not started F-16 weapons and combat training. He will do so during the fall of 2005. Given the differences between Western and Soviet-style air-combat techniques presented in section 2.2.5.2, it will be very interesting to monitor Lt Col Stepaniuk’s progress as he makes the transition from the single-role, air-to-air MiG-21 to the multi-role air-to-air/air-to-ground F-16. Although academic deadlines preclude the author from including such an analysis, this is an excellent starting point for future research on this topic (see Chapter 6). Lt Col Stepaniuk is scheduled to complete his initial F-16 training course in November 2005. He will then begin instructor pilot training early in 2006. The next 12 PoAF pilots are currently completing the 6-month English language course at Lackland AFB and will soon begin their T-38 training. While these courses are designed to help Polish MiG-21 pilots trained in the Soviet-style make a successful transition to Western aircraft and air practices, there are other aspects of the Polish Air

Force's flying culture which must also be addressed in order to achieve successful F-16 operations.

3.1.2 Fair-Weather Paradigm

Beyond Soviet influence, certain technological and budgetary constraints have caused the development of a somewhat unique flying culture within the Polish Air Force. These constraints continue to this day to have an enormous effect on the way the PoAF operates. The main culprit is the lack of an anti-icing capability on many of its legacy aircraft. To avoid potentially dangerous flying conditions caused by the accumulation of ice on the aircraft and engines [5][33], the Polish Air Force has traditionally shied away from fighter operations in freezing temperatures when visible moisture is present in the air (i.e., clouds). Because of this, the PoAF has over the years severely curtailed flight operations during the winter months [48]. The origins of this pattern find themselves in the PoAF's current pilot training program.

3.1.2.1 Polish Air Force Flight Training

The PoAF trains its pilots at the Polish Air Force Academy in Dęblin. There, cadets receive basic flight instruction during the course of their 5-year undergraduate studies [85]. After graduation and commissioning, pilots are assigned to a primary aircraft that they then learn to fly as part of an operational unit. This type of training approach is also planned for the F-16 when it arrives. After the initial group of Polish F-16 instructor pilots are trained in the US, future Polish F-16 pilots will be trained at the Krzesiny Airbase near Poznań [84].

The PoAF's current training aircraft are the PZL-130 Orlik and the TS-11 Iskra [81]. Both are subsonic and neither is equipped with any anti-icing capability whatsoever. Consequently, during periods of visual moisture and freezing temperatures, the PoAF does not operate these aircraft. Poland's climate, therefore, effectively relegates pilot training to the period between March and October. Occasionally, instructor pilots (given the right weather conditions) will fly during the winter for aerial demonstration or during special occasions. However, students generally do not fly at all during the winter months [48]. The result is that pilots effectively 'learn' not to fly in poor weather

conditions during training. The consequences are extensive in that the PoAF's Su-22 and MiG-29 squadrons to a large extent mimic the fair-weather paradigm practiced at Dęblin (even though the latter is equipped with some anti-icing capabilities) [47]. This operational pattern is further reinforced by the cost of operating the Su-22 and Mig-29.

3.1.2.2 Su-22 and Mig-29 Operational Cost

The cost of operating Poland's two current workhorse fighter aircraft, the Su-22 and Mig-29, is enormous. In 2004, the rate for one hour of flight time was approximately 60,000 PLN for the Su-22 and approximately 80,000 PLN for the MiG-29 (currently US\$1 \approx 3 PLN) [48]. Given the current PoAF budget, these costs are simply prohibitive. In order to keep its pilots proficient, the PoAF has been forced to distribute TS-11 trainers from the Polish Air Force Academy in Dęblin to the various fighter units which operate the Su-22 and MiG-29. Because the cost of operating the TS-11 is only about 6,000 PLN per flight-hour, PoAF pilots receive approximately two-thirds of their total yearly flying-time in the TS-11 instead of their primary weapons systems [48]. Consequently, PoAF fighter pilots become very proficient in flying the subsonic, fair-weather-only TS-11 basic jet trainer, while their skills in flying the much more complex, supersonic Su-22 and Mig-29 fighter aircraft atrophy. PoAF pilots simply do not fly enough in their primary aircraft to maintain a high-degree of proficiency [48]. Moreover, this budget-driven flying arrangement supplemented by TS-11 aircraft further perpetuates the fair-weather-only paradigm. Not only do these factors negatively affect the tactical capabilities of the Polish Air Force, but if continued, they will have a very negative impact on the PoAF's ability to successfully operate the F-16. The reasons for this are examined below.

3.1.2.3 F-16 Operational Paradigm

The F-16's operational paradigm is based on the fact that complex aircraft systems must be operated regularly. Not only do modern aircraft perform dependably when they are flown often [23], but frequent operations also ensure that the normal aircraft ills (e.g., leaky seals, chaffed wires, faulty systems, etc.) are constantly monitored and repaired. Because there will always be minor maintenance glitches which arise with aircraft, the USAF modus operandi is based on flushing these small problems out of the system

before they have an opportunity to become more serious. The worst thing for an aircraft system is inactivity. In the absence of frequent operation and the regular scheduled maintenance that accompanies it, potential problems which arise (e.g., a hydraulic seal which starts to leak due to the aircraft's inactivity) may not be identified until they cause an unsafe operating condition in the air (e.g., a catastrophic hydraulics failure which causes the pilot to lose control of the aircraft). Frequent flights force routine maintenance to be consistently performed and this is critical to keeping an aircraft healthy and functioning properly. Regular maintenance also keeps the technical corps trained and proficient with the aircraft's systems. In this way, when a problem does occur, the maintenance crews are able to competently and efficiently conduct repairs.

System health is merely half of the equation with respect to maintaining safe and effective aircraft operations. The other half is pilot proficiency. Between 1975 and 1993 there have been 190 Class A (major) USAF F-16 mishaps. 55% were caused by pilot error and 27% resulted in fatalities [35]. A pilot that does not fly his primary aircraft system often enough will very quickly become a liability to himself and to his squadron. In addition, the skills necessary to operate the aircraft with tactical efficacy will also deteriorate without sufficient reinforcement. These factors have led to the evolution of a 365-day-a-year flying culture in the USAF. This does not mean that every pilot flies everyday, but simply that barring any exceptionally severe weather conditions, normal flight operations are scheduled all year-round. Adapting to such a paradigm, although vital for successful F-16 operations, will be difficult for the PoAF given the current state of affairs. Beyond budgetary constraints, adjusting the institutional culture at the Polish Air Force Academy, which continues to perpetuate a fair-weather operational paradigm, is perhaps the most urgent first step in developing an all year-round approach. As mentioned earlier, a major source of the problem is the need to replace the PoAF's current fleet of training aircraft.

3.1.2.4 Need for a New Trainer

In order to facilitate its transition to the F-16 and Western air practices, it is essential that the PoAF eliminate the fair-weather flying paradigm currently in place at Dęblin. One of the biggest obstacles in achieving this is the lack of a modern training aircraft capable of 12-month-a-year operations. Beyond facilitating an all year-round mindset at

Dęblin, the need to develop an indigenous F-16 training capability makes the acquisition of a modern training aircraft increasingly urgent [54].

The PoAF's current basic jet trainer is the TS-11 Iskra. The maiden flight of this Polish-built aircraft took place in 1960. Since that time over 424 aircraft were produced and 99 are still in operation with the PoAF [54]. To its credit, the Iskra was a good lead-in trainer to earlier, slower generations of fighter aircraft such as the MiG-15. It could even be argued that with the addition of the appropriate anti-icing technology, it could remain a good quality training aircraft for pilots destined to fly slower transport aircraft such as the C-130. However, the TS-11 is at best a poor lead-in trainer to advanced supersonic fighter aircraft like the Su-22 and Mig-29 and it is completely unsatisfactory as a lead-in to the F-16 [13][54].

The Polish Air Force has long recognized its need for a new fighter trainer [34]. As early as 1976, the PoAF started an organic development program based in Mielec to design an advanced fighter trainer. The result of this effort was the so-called I-22 Iryda which was supposed to be a replacement for the TS-11. The first I-22 prototype flew its maiden voyage in 1985 and met with good reviews from pilots during testing. The Iryda was a twin-engine, two-seat jet trainer with a high wing configuration and a top speed of 0.95 Mach (just under the speed of sound). Ultimately, 19 aircraft were produced. Distribution of the aircraft to active units started in 1992. Regrettably, after 20 years of development and over US\$300 million in expenditure, the project was abruptly terminated in 1996 after two fatal crashes occurred. This setback has left the Polish Air Force in desperate need for a modern jet trainer. The situation is even more dire now that the delivery of the F-16 is on the horizon.

In order to eventually develop a self-sufficient F-16 training capability in Poland, the PoAF will need to devise a strategy for providing its student pilots with suitable lead-in fighter training in preparation for flying the F-16. As mentioned in section 3.1.1.3, USAF fighter pilots attend an intermediate training program in the T-38 aircraft upon completion of their basic jet aircraft training. This flying course provides students with the basic skills (e.g., navigation, combat maneuvers, multi-ship formations, etc.) that they will need upon entrance into F-16 training. Although the first 13 Polish pilots are

programmed to attend this intermediate fighter training course in the US, the PoAF must devise a strategy for meeting this need on a more permanent basis.

One possible solution is for the PoAF to outsource their lead-in fighter training requirement on a long-term basis. In other words, they would send their pilots abroad for an intermediate fighter training course similar to that envisioned for the initial batch of 13 Polish pilots in the T-38. This is very similar to how the Royal Danish Air Force (who also operates the F-16) accomplishes their training. They send their lieutenants from basic pilot training at the Royal Danish Air Force Academy to either Euro NATO Joint Jet Pilot Training at Shepard Air Force Base in Texas or to the NATO Flying Training School in Moose Jaw, Canada ([25], p. 20). Both schools provide lead-in fighter training in advanced supersonic aircraft. As mentioned previously, the American school flies the Northrop T-38 Talon and the Canadian school operates the BAE Systems CT-155 Hawk. The PoAF has solicited inputs from both of these schools as well as similar ones located in Finland and several other countries [47]. After going abroad for this intermediate training, Polish pilots would then return to Poland for in-house F-16 training. The option could also exist for Polish F-16 students to attend both intermediate and full F-16 training abroad. This option, in fact, would be very similar to the way the initial 13 Polish F-16 pilots will be trained. While ostensibly very convenient, outsourcing represents a short-term fix to a long-term problem. The need to train pilots will always exist and sending them abroad for training is extremely expensive. For example, the cost of full T-38/F-16 training in the US is approximately US\$2 million per student [48].

A more cost effective solution in the long term (albeit also initially expensive) would be to purchase an advanced lead-in trainer. This option would allow the PoAF to train their own F-16 pilots from scratch as early as 2008 or 2009. To this end, the PoAF is currently exploring the feasibility of purchasing a new trainer. Among the aircraft being considered are the Russian MiG-AT, the Italian Aermacchi M346, the Czech Aero Vodochody L-159, the British BAe Hawk 200 Series, the European Aeronautics Defense and Space (EADS) Mako and the American Douglas A-4 [42]. Among the supersonic trainers under consideration are the brand new Korean Aerospace T-50 and the Northrop F-5 [42]. By all accounts, the T-50 is an excellent aircraft and is probably the best choice from a technical standpoint. The problem is that the T-50 carries a hefty

price tag at approximately US\$25 million a piece and as such is simply too expensive. The American F-5 is an operational version of the T-38 advanced training aircraft. Used F-5s are currently being offered to the PoAF at a cost of approximately US\$1 million per aircraft [48]. While the Czech's are promising their support for building a joint Visegrad training center in Dęblin in exchange for the bid, the Russians, Italians and British are all negotiating manufacturing deals which could considerably bolster Poland's ailing aviation industry [42]. Although among these offers are many capable and suitable replacements for the TS-11, budgetary constraints remain the biggest obstacle to an eventual procurement.

Given the enormous costs involved, no matter what option is chosen, it is absolutely imperative that the PoAF institute appropriate service commitment contracts to ensure that the investment made in those trained continue to pay dividends for several years into the future. Such contracts are also appropriate to ensure that the technical personnel trained to maintain the F-16 will remain in place long enough to balance the similarly high cost of their training. The development of a professional maintenance corps and associated facilities is the topic of the next section.

3.2 Aircraft Maintenance and Airfield Infrastructure

In addition to adjusting the flying culture among Polish aircrews to fit a new operational paradigm, the Polish Air Force is adapting its force structure and maintenance facilities to meet the needs of the F-16. Analogous to the operational culture which has evolved among Western F-16 pilots, a specific maintenance culture has developed among Western F-16 technicians. This culture is rooted in technical expertise and exists among a corps of professional enlisted personnel. Because such a maintenance culture has traditionally not existed within the Polish Air Force, developing one is essential to the long term success of F-16 operations. The next two sections investigate ongoing efforts by the PoAF to cultivate the appropriate maintenance environment.

3.2.1 Maintenance Personnel

One of the remnants of the Soviet system that persists in today's PoAF is a military culture characterized by high degrees of both uncertainty avoidance and power distance

(see section 2.2.4). The former continues to manifest itself in that decisions which in Western militaries would be made at fairly low levels are often pushed to very high levels in the chain of command in the PoAF. This relic of the old system stems from the fact that there were often very severe consequences when military operation did not go as planned. As explained in section 2.2.4, it was common practice for officers during the Soviet era to avoid blame by passing even the most routine decisions up the chain of command. To a large extent, this modus operandi continues to govern the way business is conducted within the Polish Air Force today. The United States Air Attaché at the American Embassy in Warsaw corroborated this in a personal interview conducted by the author on June 2nd, 2005.

Whenever I sit across the table from the current [PoAF] Chief of Staff (a one-star general) and ask him for a decision about a certain action, his closing statement is that ‘this is probably not my decision and I’ll have to go talk to the [Polish] Air Chief (a three-star general).’ After sitting through three or four of these sessions, I decided to go straight to the Air Chief. Many [PoAF] generals in headquarters operate in this fashion. Among them are the Chief of Training and the Chief of Logistics. They are products of the old system and attended Soviet war colleges 20 or so years ago.

Beyond being a very cumbersome system, the top-heavy hierarchy propagates an institutional culture within the PoAF typified by a high degree of power distance. The separation in power is most evident between the officer and enlisted ranks. Analogous to the situation described by Henderson in section 2.2.4, many of the responsibilities that Western militaries entrust to enlisted personnel continue to be carried out by commissioned officers in the PoAF. In the field of aircraft maintenance, this means that officers often conduct repairs and other technical work on aircraft. Because training enlisted personnel to conduct aircraft maintenance is far more cost effective and operationally efficient, such duties in the USAF are almost exclusively performed by professional enlisted personnel.

In the USAF, officers form the bulk of the pilot corps and professional enlisted personnel make up the majority of the maintenance corps. The professional enlisted

corps is populated by people who usually volunteer for military service directly after high school. They receive technical and mechanical training upon entry into the service in lieu of the university education required of officers. After their initial training, they are assigned to operational units as technicians and mechanics. Through their subsequent assignments, they become maintenance experts in one or more aircraft weapon systems. This technical career path, which in many ways mirrors that of the pilot corps, is an integral part of the maintenance culture in the USAF. Those that continue to advance in rank become non-commissioned officers (NCOs). In most Western forces, NCOs play a vital role in bridging the gap between enlisted personnel and officers. They are routinely entrusted with large amounts of technical and supervisory responsibility and often fill roles commensurate with those of junior commissioned officers. In this way, the power distance between officers and enlisted personnel is considerably reduced.

Traditionally, the PoAF's enlisted corps has been almost entirely made up of conscripts and the majority of career personnel were officers. Consequently, the NCO corps in today's PoAF remains extremely small. Consistent with the situation described in section 2.2.4, the lack of a strong NCO corps creates a leadership void between officers and enlisted personnel. The resulting large power distance between the two groups causes the NCOs which do exist to be underutilized. They often conduct mundane tasks similar to those performed by conscripts and are rarely entrusted with any measure of responsibility [47]. Consequently, many NCOs in the PoAF lack the technical skills and supervisory experience which would make them valuable commodities when the F-16s arrive. This fact is driving the Polish Air Force to begin developing the necessary professional enlisted corps which will ultimately be entrusted with the care and feeding of the new aircraft.

To this end, the Polish Air Force has identified approximately 140 professional enlisted personnel who are presently undergoing F-16 maintenance training at USAF facilities [47]. Among them, many will be trained as maintenance instructors. Upon their return to Poland, they will be charged with training hundreds of additional enlisted personnel necessary to care for a total fleet of 48 F-16 aircraft. In preparation, more than 340 conscripted enlisted personnel at the Krzesiny Airbase will be replaced with professional enlisted personnel [51]. Developing this initial cadre of experts into a

professional technical corps will be a key ingredient in the evolution of a successful maintenance culture in the PoAF. An essential element in this process will be promoting cultural change among the officer corps so that it proactively encourages and empowers this new body of professional enlisted personnel to develop into a self-sufficient bastion of technical and maintenance expertise. To facilitate these efforts, exchange programs for both Polish officers and enlisted personnel to attend USAF leadership academies in Germany and the US are currently being planned [47]. While generating the appropriate maintenance personnel is of vital importance, it is only half of the maintenance equation. The other half is facilities.

3.2.2 Facilities

Because Poland received most of its military aircraft from the Soviet Union, much of the maintenance infrastructure required by the F-16 simply does not exist in Poland. As discussed in section 2.2.5.1, the Soviet production strategy for fighter aircraft was to produce mass quantities of highly robust and capable aircraft sometimes at the expense of precision finishing and quality control. This strategy was designed to ensure that they would be prepared (at realistic production cost) to fight a high intensity European conflict in which they would potentially need to endure heavy losses of aircraft ([38], p. 71). The necessity to accept quantity over quality, however, did not come without its set of drawbacks. Probably the most severe penalty in this regard was an extremely high operational cost caused by compromises in machining and fabrication standards. Examples of this are plentiful from both the civilian and military sides of the Soviet aircraft industry. One excellent civil example concerns the Soviet Tu-154 jetliner.

The Soviet Union entered the export market for jet airliners in the early 1970s with its medium range Tu-154 aircraft. Although the Soviets offered the Tu-154 at a cost of about one-half that of a Boeing 747, the Tu-154's very short 'time between overhauls' (TBO) made it extremely expensive to operate. The TBO for the Tu-154 was only about 600 flight hours compared to 3,000 for the 747 [72]. Its high operating cost subsequently led to the cancellation of many Tu-154 orders despite its relatively low purchase price. A similar situation exists with the engines used to power the Su-22 and Mig-29 fighter aircraft.

One of the reasons that the Su-22 and MiG-29 aircraft are so expensive to operate (see section 3.1.2.2) is that their engines must be removed and replaced after only 350 to 400 flight hours [47][75]. These mass-produced engines, while tremendously powerful and robust, were intended by design to be effectively disposable. This fact reduced production costs, loosened machining tolerances and mitigated the consequences of foreign object damage (FOD). In other words, these engines were intended to minimize design uncertainty. In contrast, F-16 engines were designed with a much longer lifecycle in mind and operate for approximately 4,000 flight hours between overhauls [24][29]. Consequently, F-16 engines are more expensive to produce, more delicate on the ground and more susceptible to FOD damage than MiG engines. The payoff is that while an F-16 engine also provides an enormous amount of thrust, it does so at a significantly lower operational cost than its Soviet counterparts.

Consistent with a design philosophy based on mass production of robust but short-lived systems, the Soviets would often recall aircraft from Warsaw Pact forces that were in need of extensive repairs and replace them with operational ones [47]. Their maintenance paradigm, consistent with the theme of strong central control from the Soviet Union, simply didn't allow for a great deal of thorough, comprehensive aircraft maintenance to be conducted in its satellites. As a result, the in-depth maintenance facilities which are a standard part of any Western air force base (e.g., back-shops, depots, precision measurement facilities, etc.) simply do not exist on many Polish military installations [47]. Because the F-16's maintenance paradigm is based on an intricate system of intrusive and invasive maintenance, such facilities must be developed in Poland. Construction is currently in progress.

Most of the development is occurring at Krzesiny and Łask Airbases which will accommodate the first operational squadrons of F-16s. When completed, these installations will to a large degree resemble American fighter bases in terms of their design and facilities. The majority of the construction has been carried out by Polish companies. The value of the work in just over two years has totaled over US\$1.6 billion of which approximately half has been provided by NATO Security Investment Program Funds (see section 1.2.2). Among the items being constructed are hangars, back-shops, measurement facilities, maintenance depots, fuel depots, runways, taxiways, aprons, lighting facilities, weapons facilities and navigation systems [51]. The construction of

this infrastructure represents the foundation on which the future of the PoAF's NATO air operations will be built.

4 The Future of Polish Airpower

4.1 Vision

While many European nations are reducing their force structures, Poland is currently expanding and modernizing its military capacities. As presented thus far, this is especially true of the Polish Air Force which has decided to purchase 48 F-16 fighter aircraft. The PoAF's vision for its future is based on building a set of capabilities (e.g., air-to-ground, air-to-air, air reconnaissance, air transport, maintenance and logistical support, etc.) which will eventually allow the Polish Air Force to project airpower (albeit on a small scale) anywhere in the world. Because such assets are extremely valuable to NATO, developing them will enhance Poland's influence in transatlantic security matters and augment Poland's political clout within the European Union and beyond. In addition to expanding Poland's political/military power, the PoAF's modernization efforts are bringing with them supplementary military aid (see section 1.2.2) and foreign investment. Not only do such by-products facilitate further military progress, but they also help to build industrial infrastructure and to bolster Poland's economy.

For example, major modernization projects, such as the US\$3.5 billion F-16 order and its associated US\$6.0 billion offset deal from Lockheed Martin (LM), have had a very favorable effect on the Polish defense industry. Polish defense companies have enjoyed many new orders resulting both from Poland's preparations to fly the F-16 as well as Polish military activities in Iraq and Afghanistan. Military exports are projected to reach 2.17 billion PLN this year, up from 1.38 billion in 2004 and 1.14 billion in 2003 [2][59] (currently US\$1 \approx 3 PLN). In addition, LM is bringing advanced technology and new investment into the Polish defense sector. Current projects include the assembly of an explosives plant in Pionki, the creation of an aviation institute in Rzeszow and the development of an F-16 repair center in Bydgoszcz [60]. Beyond the defense industry, LM is instigating significant investment in the civil sector by such companies as General Motors who will produce their new Opel Zafira automobile in Gliwice [57]. Despite the tangible political, military and economic benefits of the

Polish Air Force's aspirations, success will require a major military transformation and the resolution of some difficult issues.

4.2 Challenges

The F-16, which will be the first Western aircraft in the PoAF's inventory since WWII, represents the future of Polish airpower and is driving the transition to Western practices. As presented in Chapter 3, preparation efforts are serving both to identify necessary changes and to facilitate their implementation. In this way, the F-16 is enabling the PoAF to overcome many past barriers and accelerate its progress in becoming a modern, Western air force. Despite this, many obstacles still remain. Although growing pains are certainly to be expected considering the enormous scope of the current transformation effort, the issues outlined below need to be addressed in the immediate future to prevent them from derailing or delaying the PoAF's efforts to realize its vision.

4.2.1 Regular Operations

A persistent theme throughout this thesis has been that in order for the Polish Air Force to successfully operate the F-16, it will need to keep all available F-16 pilots and aircraft in the air on a regular basis (i.e., to employ a 365-day-a-year flight schedule; see section 3.1.2.3). The following obstacles stand in the way of realizing this goal.

4.2.1.1 Budgetary Constraints

Although the cost per flight-hour of the F-16 is much less than that of the Su-22 or Mig-29 (see section 3.1.2.2), maintaining a normal, all year-round, Western flight schedule (see section 3.1.2.3) for a fleet of 48 F-16 aircraft will nonetheless introduce a new level of expense to the PoAF. This comes as the Polish Air Force faces dramatic under funding stemming from years of defense draw-down after the collapse of the Warsaw Pact. Over the past 15 years, Poland's standing military has been reduced by approximately two-thirds from 400,000 to 135,000 personnel. Because many of the superannuated personnel draw pensions, nondiscretionary spending continues to eat up significant portions of the 1.89% of Gross National Product (or US\$6 billion in 2005)

which Poland has allocated to defense [68]. In 2005, pensions and active duty salaries made up approximately 52% of the entire defense budget, while just 28.6% was allocated to operations, maintenance and training [50].

The leadership of the Polish Air Force has openly acknowledged its concerns about its ability to operate the F-16 given its current operational budget of approximately 900 million PLN (currently US\$1 \approx 3 PLN) [50]. As presented in section 3.1.2.2, the PoAF has been having a very difficult time trying to keep its existing fleet of Su-22 and MiG-29 aircraft aloft on this budget. Because of this, the former Chief of the Polish Air Force, Lt Gen Olszewski, broached the topic with the Polish Defense Minister and asked for an increase in budget authority in order to cover the additional costs associated with operating the F-16. The response he received was that no supplement would be forthcoming and that the PoAF would need to figure out how to operate its F-16s using its existing budget [47]. In the past, the PoAF leadership has used strategies like those outlined in section 3.1.2.2 which utilize training aircraft to cost effectively augment flight operations. As presented in section 3.1.2.3, such strategies would spell disaster for the F-16 in terms of both system reliability and pilot proficiency. It appears that the only way to stretch the PoAF's current operating budget far enough to sustain regular flight operations for the F-16 may be to retire the aging and operationally expensive Su-22 and MiG-29. In any event, this budget issue needs to be addressed urgently in order to avoid the looming operational debacle which will occur if the F-16s start to arrive and cannot be flown consistently due to the unavailability of funds. As discussed in section 3.1.2.4, budgetary constraints are also inhibiting the PoAF from replacing its aging fleet of training aircraft.

4.2.1.2 Replacing the TS-11

PoAF's budget for procurement and infrastructure for 2005 is approximately 700 million PLN and is also very tight. In a similar conversation to the one described in the previous section, the Polish Minister of Defense informed the Polish Air Chief that the PoAF can acquire any new training aircraft it wants as long as it works within its current procurement budget [47]. This of course was a non-starter because there simply is not enough money in the PoAF procurement budget to purchase a new trainer. This state of affairs has caused the PoAF's leadership to reluctantly accept the idea that it will need to

continue to rely on the TS-11 for training even when the F-16 arrives. In spite of this, it is widely acknowledged that the TS-11 won't last much longer and needs to be replaced.

The current Polish Air Chief, Lt Gen Targosz, does concede that even if the TS-11 continues for the time being to form the basis of the PoAF's training fleet, an intermediate step will be required to transition students from the TS-11 to the F-16 [47]. The PoAF will most probably outsource this intermediate training requirement on a long-term basis as discussed in section 3.1.2.4. Following this course doesn't in anyway address the need to replace the TS-11 and will require that the appropriate training funds be set aside on a yearly basis in order to pay for training abroad. Not only could the procurement of a new trainer fulfill this long-term training requirement, but it would be instrumental in bringing an end to the fair-weather flying mentality inculcated at the Polish Air Force Academy (see section 3.1.2.4). Establishing the precedent of flying all year-round in Dęblin is instrumental to establishing an operational culture within the PoAF which expects to fly on a regular, consistent basis. Also vital to this end (and perhaps even more pressing in the short term) is ensuring that an adequate number of Polish F-16 instructor pilots exist from the very beginning.

4.2.1.3 F-16 Instructor Pilots

In November 2006, the first four F-16s will arrive in Poland. From then on, four more aircraft will arrive every other month until a total of 48 aircraft are delivered. The key to a successful transition is to start regular operations immediately. To their credit, the Polish Air Force has been working very diligently to avoid a situation where more aircraft exist than pilots to fly them. As explained in section 3.1.1, 13 Polish Air Force pilots are currently undergoing F-16 training in the US and 6 of the 13 will be trained as instructor pilots. In addition, the PoAF has decided to send another 24 Polish pilots to the USAF's T-38 intermediate fighter training program. Although this will provide an ample supply of students qualified to begin F-16 training in Poland, it does not address the need to develop a commensurate number of appropriately trained F-16 instructor pilots.

Flight training in the F-16 is very intense and demands a lot from both students and instructors. A normal training day including pre-flight preparation, briefing, flight and

debriefing routinely occupies one instructor and one student for an entire day. To make acceptable progress, students usually fly 2 to 3 times a week. Thus, one instructor pilot who flies 4 or 5 times a week will be able to train about 2 students at a time.

Currently only 6 Polish F-16 instructor pilots are planned to be in place when delivery of aircraft begins. These 6 will be pitted against 24 students returning from T-38 training in the US and 7 more who are F-16 qualified but require additional training to become instructors. This bottleneck will make it impossible for students in the queue to maintain proficiency and thus will dramatically increase the likelihood of accidents. Furthermore, as more and more aircraft arrive, a shortage of F-16 instructors will eventually lead to a shortage of qualified F-16 pilots. This is the very situation that the PoAF is hoping to avoid and would lead to aircraft inactivity and potential maintenance problems. In short, starting off without an ample number of instructor pilots could send the whole operation spiraling out of control and take the PoAF years to recover from.

To try to avoid a shortage of instructor pilots, the leadership of the Polish Air Force is currently examining the possibility of providing the additional 24 Polish pilots who will receive T-38 training in the US with F-16 training as well. Under the proposed arrangement, 12 of the 24 would be trained as instructors. Such foresight and planning may be a positive side effect of the PoAF's propensity toward uncertainty avoidance (see section 1.3.3.2 and 3.2.1) [74]. The main obstacle in pursuing this option is finding the necessary funding. One possibility would be to rearrange portions of the original contract in order to include additional training in exchange for surplus weaponry. Such adjustments are a standard part of the defense acquisition process in the US and would make a lot of sense in this situation. The idea of reallocating funds within the original contract, however, is not a popular option with the PoAF's leadership [47]. This is because changing anything in the original contract would require the PoAF to go back to parliament in order to get approval. The perception is that this would involve admitting that a mistake had been made (even if this is not the case) and as presented in section 3.2.1, their tendency to avoid uncertainty makes the leadership of the PoAF extremely reluctant to do this. Consequently, the PoAF is trying to find the necessary funding elsewhere. Funding limitations are also effecting the construction of some key training facilities.

4.2.2 Other Issues

4.2.2.1 Training Facilities

In addition to qualified pilots and capable maintenance personnel, developing and maintaining the skills to persecute effective tactical operations require the proper training facilities. A good example is an air-to-ground bombing range. Such ranges allow pilots to practice proper weapons delivery procedures and eliminate faulty ones. At the present time, the PoAF operates a practice range in Nadarzyce (near Powidz Airbase). Because this range is unmanned and lacks a tower, scoring is only possible through special arrangements and even then it takes hours for the necessary ground triangulations to be conducted [48]. To be truly effective in increasing proficiency, it is essential that a bombing range provides immediate feedback on how successfully pilots hit their targets.

Extensive refurbishments are necessary to the range in Nadarzyce in order to make it a useful training facility. At the present time, plans to do so have not yet been broached. One of the biggest challenges which the PoAF faces is bringing its operational capabilities in line with Western standards. Postponing the construction of such vital training facilities as a modern air-to-ground practice range will simply delay the PoAF in its quest to become a valuable NATO resource. Even more critical delays could result if the construction which is currently underway is not completed on schedule.

4.2.2.2 Foreign Object Damage (FOD) Awareness

Although construction of the F-16 facilities at the Krzesiny and Łask Airbases is well underway, the Polish military has expressed some concern over delays caused by problems with Polish building contractors [51]. Referring to the F-16 construction efforts, the Polish Deputy Defense Minister Janusz Zemke stated recently that, "We adopted the principle that the work would chiefly be handled by Polish companies. There are sometimes difficulties with some of them." Zemke quickly pointed out reassuringly that Polish contractors often accelerate their progress significantly after the first year [51]. Referring to the F-16's susceptibility to FOD, Polish Defense Minister Jerzy Szmajdzinski added that, "The F-16s are extraordinarily strong in the air, but

extraordinarily delicate on the ground. And so, there cannot be a construction site present when they arrive" [51].

The fact that the F-16's engine is attached to the underbelly of the aircraft and thus relatively close to the ground makes it exceptionally predisposed to ingestion hazards. Because of the placement and design of Soviet engines (see section 3.2.2), FOD concerns were not nearly as significant as they are with the F-16. Consequently, cultural awareness of FOD and its prevention does not currently exist within the Polish Air Force and will need to be developed before the first F-16s arrive. An excellent illustration of this fact is associated with the base design at Łask.

At Łask, the original F-16 layout was supposed to be constructed in a manner characteristic of Western-style NATO airbases. Such designs typically position the squadron operations building far enough away from the aircraft area to reduce the risk of FOD damage. When the former Polish Air Chief saw the plans, he repositioned the squadron operations building to be located in the center of the aircraft tree from which the F-16s will be operated [48]. This type of squadron design was typical during the Soviet era. The problem is that debris brought into the F-16 operating area on the shoes and tires of personnel walking and driving across the taxiway to the operations building creates a tremendous FOD hazard. In changing the design to one that he was more familiar with, the former Air Chief failed to appreciate the FOD hazard that it would create. Consequently, preventative measures will be necessary in order to avoid FOD damage due to this base redesign. Unfortunately, it may take the destruction of a few F-16 engines to provide sufficient impetus for action and to encourage the necessary cultural awareness.

5 Summary

Because the transatlantic security concept in Europe remains very important to Poland's national security [65], its goal of becoming a valuable military contributor to NATO is well founded. The central pillar of the Polish Air Force's aspirations in this regard is the purchase of 48 American F-16 fighter aircraft. Not only will the modern and versatile F-16 augment Poland's existing military capabilities enormously, but preparations to operate it have significantly accelerated modernizations within the PoAF. Because the F-16 represents a tangible departure from Soviet influence in both hardware and operations, it is enabling the Polish Air Force to overcome institutional resistance which has hindered transition to Western air practices in the past.

Successfully converting to the F-16 will depend on achieving two main goals. The first is associated with operational style. In order to effectively employ the F-16 as a weapons system, Polish pilots must abandon their Soviet-style dependence on ground control and adopt a Western flying style characterized by spontaneous initiative from the cockpit. In more general terms, the Polish Air Force must make a fundamental shift away from a scripted collectivistic approach to flying and towards a more free-form individualistic style. While the Soviet-inspired ground-directed approach was very much consistent with the philosophy of strong centralized control at all levels, Western pilots enjoy much more autonomy in mission execution. While empowering pilots to make decisions based on their independent judgment, the latter style places very high demands on a pilot's ability to gather, interpret and react to information. As observed by the very high attrition rates among former GDR pilots seeking to reintegrate themselves into the Luftwaffe (see section 2.3.1), making the transition between philosophies is no small feat and should not be underestimated.

The experiences of the first Polish pilot to attend F-16 training in the US have been instrumental in identifying potential areas of difficulty. Based on his results, the PoAF has been able to carefully craft an initial, US based training program that will provide Polish pilots with a broad exposure to Western operations and flight procedures. The training program will include 6-months of English language instruction, 50-hours of intermediate fighter training in the T-38 and full instruction in the F-16. It will be

incumbent on the 13 Polish pilots who complete this training course to disseminate what they have learned when they return to Poland. The influence of these officers, combined with active participation in NATO exercises, will serve to reinforce Western tactical approaches and to expand Polish operational capability. Because sowing the seeds of operational change is an enormous undertaking for just 13 men, the PoAF is currently trying to find additional funding which would enable another 24 Polish pilots to attend the T-38/F-16 training program in the US. This would not only be advantageous in terms of disseminating Western practices, but also to ensure that an ample number of Polish F-16 instructor pilots exist to begin a robust training program as soon as the aircraft start to arrive. Achieving this goal will be instrumental to the second overarching objective which is flying the F-16 in a consistent and frequent manner.

This second objective in many ways is even more fundamental than the first. Over 25 years of flight experience with the F-16 has shown that successful operations require regular, frequent and continuous flight activity. As presented in section 3.1.2.3, failing to do so creates an unsafe operating environment both in terms of pilot proficiency and system reliability. Achieving a consistent, 365-day-a-year flight schedule is a multifaceted endeavor. Not only does it entail establishing a year-round flying culture at the Polish Air Force academy, generating sufficient numbers of F-16 instructor pilots and developing the appropriate maintenance expertise and infrastructure, but also allocating a large enough budget to sustain the daily operations of a fleet of 48 aircraft. As discussed in section 3.1.2.2, the PoAF's operating budget is currently curtailing its ability to operate its existing fleet of fighter aircraft, let alone additional F-16s. Because this issue is so fundamental in developing and sustaining successful F-16 operations, it must be addressed immediately and may require drastic measures. As suggested in section 4.2, such measures may hasten the retirement of Poland's current fleet of aging and operationally expensive Soviet aircraft.

This thesis has presented some of the most salient issues and obstacles which confront the PoAF as it prepares to operate its first Western fighter aircraft since WWII. Because of lingering Soviet influence in aircraft, flight operations, maintenance, etc., the conversion to the F-16 will require an enormous transformation on the part of the Polish Air Force. Although the scope of the necessary changes is extensive and the process is not without its share of challenges, the PoAF should be commended for its aggressive

pursuit of a very commendable objective. Successfully developing the ability to operate the F-16 will mark an important milestone in the PoAF's reemergence from the shadows of the Soviet era to once again claim the prestige that it earned in the skies over Britain in 1940.

6 Future Work

As mentioned in Chapter 5, one of the biggest challenges for Polish pilots will be to adapt to a system that is based on decentralized mission execution and spontaneous initiative from the cockpit. Although the first Polish F-16 pilot was able to shed some light on this process, his training in the F-16 is currently incomplete (see section 3.1.1.3). An excellent starting point for further research would be to follow Lt Col Stepaniuk and the other initial 12 Polish pilots as they finish their training in the US and begin flying the F-16 operationally in Poland. The perspectives of these pilots would be particularly interesting as they continue to gain exposure to Western air operations through participation in NATO air exercises.

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